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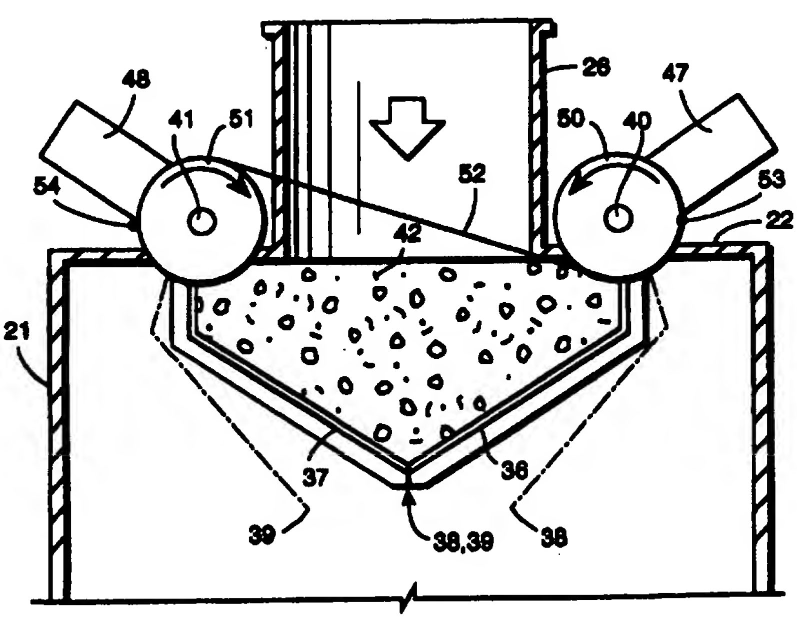
(54) Title: METHOD AND APPARATUS FOR CONTROLLING AND DIRECTING THE FLOW OF CHIPS INTO A CHIP BIN



(57) Abstract

The chip supporting gates (36, 37) in a chip bin assembly (20-28) are mechanically mounted for synchronous movement so that chips flowing into the chip bin (20) interior between the gates (36, 37) falls into the chip bin (20) (e.g., substantially along its center line). This results in more uniform flow within the chip bin (20) with resultant uniformity of steaming. Particularly useful are single-convergence types of chip bin transitions (30). Mechanical synchronisation between the gates is provided by sprockets and chains, sheaves and V-belts, pulleys and toothed belts (50, 51, 52, 56, 57, 58) directly intermeshing gear segments (60, 61, 62, 63), rack and gear elements (50, 51, 64, 66), linkages (101-105), or hydraulic components.

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METHOD AND APPARATUS FOR CONTROLLING AND DIRECTING THE FLOW OF CHIPS INTO A CHIP BIN

BACKGROUND AND SUMMARY OF THE INVENTION

In conventional continuous digester chip feeding systems, such as those sold by Kamyr, Inc. of Glens Falls, New York under the trademark KAMYR®, wood chips, or like comminuted cellulosic fibrous material, are initially treated in a cylindrical vessel or hopper known as a chip bin. The flow of chips into the bin is controlled by counterweighted chip gates, such as shown in U.S. patent 4,927,312. While such counterweighted chip gates have proven to be an effective device for controlling the flow of chips into the bin while preventing gases (such as air) from entering the bin through the gates, they are a source of potential non-uniform movement of the chips.

When conventional gates are utilized, the gates can deflect independently of each other, providing the potential for one gate to be more open than the other. The resulting chip flow can then be excessive on one side of the bin compared to the other, rather than providing uniform flow to the center of the bin. This non-uniformity is especially important with new styles of chip bins, such as shown in co-pending application serial no. 08/189,546 filed February 1, 1994, which utilize single convergence type bin transitions, such as shown in U.S. patent 4,958,741 and sold by J.R. Johanson, Inc. of San Luis Obispo, California under the trademark "DIAMONDBACK HOPPER®". The new style chip bins have been shown to improve the flow of chips within the bin and to obviate the need for a vibrating bottom section which is utilized in conventional chip bins, and it is highly undesirable to have the improved uniformity of this

new generation of chip bins be somewhat negated by the particular feeding mechanism for introducing the chips or other comminuted cellulosic fibrous material into the chip bin.

According to the present invention the potential non-uniformity problems associated with conventional counterweighted chip gate assemblies are eliminated in a simple yet effective manner. According to the most basic aspects of the present invention, the movement of the chip gates is synchronized (preferably mechanically) so that one does not "open" more than the other, and so that therefore the chips are deposited on substantially the center line of the chip bin, providing uniform movement of the chips in the chip bin, and uniform steaming. In addition to providing better uniformity, the synchronized gate arrangement of the invention produces an even tighter gas seal than in conventional gate arrangements. The tighter seal against the entry of gases, such as air, into the chip bin stabilizes the control of the pressure (e.g. vacuum or overpressure) within the bin. For example a more stable control of vacuum within the bin is provided which minimizes the release of malodorous gases from the bin. Also stabilization of pressure within the bin reduces the chance for fluctuations and exhaust gas flow to the non-condensible gas (NCG) collection system, thus improving the operation of that system, particularly when used in conjunction with system components as shown in U.S. patent 5,169,498 and co-pending application serial no. 08/317,801 filed October 4, 1994 (atty. dkt. 10-1005).

According to one aspect of the present invention a chip bin assembly is provided comprising the following components: A generally vertical vessel having a top and a bottom and a generally hollow interior, and an inlet for fluent solid material at the top thereof for introducing fluent solid material into the interior. First

and second gates mounted within the vessel interior beneath the inlet, the gates each mounted for pivotal movement about a generally horizontal axis for movement from a first position in which the gates are substantially in engagement with each other at an area of engagement to preclude the passage of fluent solid material from the inlet into the vessel interior, to a second position in which the gates are spaced from each other a distance sufficient to allow passage of fluent solid material between them into the vessel interior. Mechanical means for biasing the gates to the first position. And, mechanical means for synchronizing movement of the gates between the first and second positions so that fluent solid material flowing into the vessel interior between the gates falls into the vessel interior substantially immediately beneath the area of engagement of the gates when in the first position.

In the chip bin assembly as described above it is preferred that the mechanical biasing means comprise counterweights, and it is preferred that the chip bin vertical vessel itself include a single-convergence type bin transition so that the need for a vibratory discharge is eliminated, the bottom of the vessel being connected directly to a chip meter or low pressure feeder. The mechanical means preferably comprise first and second parallel generally horizontal, and horizontally spaced, shafts which have sprockets, sheaves, or pulleys movable therewith, and interconnected to each other by chains, V-belts, or toothed belts. Two or more sets of sprockets, etc. are preferably provided to ensure positive synchronized movement.

Alternatively the mechanical means may comprise gear segments, having teeth which directly intermesh with each other, or which operatively intermesh with each other through a rack and idler gear. The gears may themselves comprise the counterweights. Or the

mechanical means may comprise linkages, or even hydraulic elements.

According to another aspect of the present invention an inlet system for allowing entrance of fluent solid material into a hollow vessel interior is provided. The inlet system comprises the following elements: First and second generally horizontal parallel shafts, horizontally spaced from each other defining first and second axes, respectively. First and second gates mounted to the first and second shafts, respectively, for movement with the shafts, each gate having an abutment portion adapted to abut the other of the gates to provide a seal substantially precluding the passage of fluent solid material therebetween. First and second counterweights connected to the first and second shafts, respectively, for biasing the shafts to a first position in which the gate abutment portions substantially abut each other. First and second mechanical elements, distinct from the gates, connected to the first and second shafts, respectively, for movement with the shafts about the first and second axes. And, at least one mechanical interconnecting element for interconnecting the first and second mechanical elements to provide substantially synchronized movement thereof.

The first and second mechanical elements may, as described above, be sprockets, sheaves, or pulleys, in which case the at least one mechanical interconnecting element comprises a chain, V-belt, or toothed belt. Alternatively the first and second mechanical elements may comprise gears with the at least one mechanical interconnection comprising gear teeth formed on the gears which directly intermesh with each other, or intermesh through a rack and idler gear.

According to yet another aspect of the present invention a method of acting upon comminuted cellulosic fibrous material, utilizing a chip bin having a top with a material inlet, and first and

second gates beneath the inlet, the gates having abutment portions for engagement with each other, (*e.g.*, the abutment portions being substantially on a vertical centerline of the chip bin when the abutment portions are in engagement with each other), is provided. The method comprises the following steps: (a) Introducing comminuted cellulosic fibrous material into the chip bin inlet to fall onto the gates, supported thereby. (b) Biasing the gates toward a first position in which the abutment portions of the gates engage each other and substantially preclude the passage of comminuted cellulosic fibrous material therebetween. And, (c) when the weight of the comminuted cellulosic fibrous material exceeds the bias provided in step (b), causing the abutment portions of the gates to move, in substantially synchronous movement, away from each other, so that the comminuted cellulosic fibrous material falls between the gates into the chip bin interior (*e.g.*, substantially at the centerline of the chip bin).

Step (b) may be practiced is practiced by biasing the gates toward each other with counterweights. Step (c) may be practiced by mechanically synchronizing the movement of said gates toward and away from each other. Normally the further step (d), of steaming the chips in the chip bin, is also practiced.

It is the primary object of the present invention to provide more uniform feeding of wood chips, or like comminuted cellulosic fibrous material, into a chip bin in a conventional continuous digester system, such as a kraft digester system. This and other objects of the invention will become clear from an inspection of the detailed description of the invention and from the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURES 1 and 2 are top and side views, respectively, of conventional prior art chip gate assemblies and conventional chip bins;

FIGURE 3 is a side view of an exemplary chip bin utilizable according to the present invention;

FIGURES 4 and 5 are schematic side and top views, respectively, of an exemplary inlet system for a chip bin, according to the present invention;

FIGURE 6 is a view like that of FIGURE 4 for an alternative embodiment;

FIGURES 7 and 8 are a side view and a top view, respectively, of just the mechanical interconnections and between the shaft-supporting the chip gates which may be used instead of the gear segments of FIGURE 6; and

FIGURE 9 is a schematic side view of a linkage mechanism that may be used for gate synchronous movement.

DETAILED DESCRIPTION OF THE DRAWINGS

FIGURES 1 and 2 show conventional first and second chip gates 10, 11 which are normally biased together by counterweights 12, 13 to the solid line position illustrated in FIGURES 1 and 2 in which abutment portions 14, 15 thereof are in engagement to provide

a generally gas tight seal in addition to supporting chips on the upper surfaces thereof. The counterweights 12, 13 typically rest against bumpers 16 when in the solid line position illustrated in FIGURE 2, and move to the dotted line position when the weight of chips on the gates 10, 11 overcomes the bias of the counterweights 12, 13 causing the chips to flow from the inlet 17 through the top 18 into the hollow interior of the chip bin. While the prior art system of FIGURES 1 and 2 is typically very effective, there can be circumstances in which one of the gates 10, 11 opens a different amount than the other gate. This results in the chips being deposited into the chip bin not directly along the center line, but off to one side, with a resulting potential non-uniformity of steaming or other treatment in the chip bin.

FIGURE 3 illustrates a relatively recent style of improved chip bin 20 which comprises a vessel 21 which is generally vertically oriented, having a top 22 and a bottom 23. An inlet 24, including an air lock 25 and a conduit 26 extending downwardly from the air lock 25, is provided at the top 22 while the bottom 23 is connected directly to a chip meter 27 and/or low pressure feeder 28, which are in turn connected (through known or conventional mechanisms), as indicated schematically at 29 in FIGURE 3, to a continuous (e.g. kraft for sulfite) digester system or the like. The chip bin 20 illustrated in FIGURE 3 has single-convergence type transitions as illustrated schematically at 30, and such as disclosed in U.S. patent 4,958,741 and sold by J.R. Johanson, Inc. of San Luis Obispo, California under the trademark "DIAMONDBACK HOPPER®", and such as shown in co-pending application serial no. 08/189,546 filed February 1, 1994. The chip bin 20 does not need a conventional vibratory discharge, allowing the bottom 23 to be directly connected to the chip meter 27 and/or low pressure feeder 28.

As is conventional, the chip bin 20 includes means for adding steam to the interior of the vessel 21 to uniformly steam the chips therein, the steaming means being provided in the exemplary embodiment illustrated in FIGURE 3 by headers 31 connected by various connections 32 or the like to the interior of the vessel 21, and to a source of steam via conduit 33. An NCG system (not shown) is typically also associated with the chip bin 20, such as shown in co-pending application serial no. 08/317,801 filed October 4, 1994.

One embodiment of an inlet system for a chip bin (such as for the chip bin 20, although also usable with other more conventional types of chip bins) according to the present invention is shown schematically in FIGURES 4 and 5. Associated with the inlet conduit 26 are the first and second gates 36, 37 which preferably have abutment portions 38, 39 thereof (in particular see the dotted line position in FIGURE 4) which substantially abut each other (providing a generally gas tight seal) in the first, solid line, position illustrated in FIGURE 4, and movable therefrom to the second, spaced, position thereof illustrated in dotted line in FIGURE 4.

The gates 36, 37 are operatively connected to first and second shafts 40, 41, respectively, which shafts 40, 41 are substantially parallel to each other, extend generally horizontally, and are horizontally spaced from each other, typically being provided on the opposite sides of the inlet conduit 26 and mounted at the top 22 of the vessel 21. As is known per se in the conventional chip gate assemblies of FIGURES 1 and 2, side plates 42 (only the rear one of which is seen in FIGURE 4, the front one having been removed for clarity of illustration) are provided to cooperate with the gates 36, 37 in providing a generally air tight seal when the portions 38, 39 abut each other as seen in solid line in FIGURE 4, and as seen in FIGURE 5.

The shafts 40, 41 define generally horizontal axes, such as the axes 43, 44 seen in FIGURE 5, about which the gates 36, 37 are pivotal. Conventional bearings 45, 46, may be mounted associated with the shafts 40, 41 to allow rotational movement thereof (with corresponding pivotal movement of the gates 36, 37) in response to, or overcoming, the bias provided by the counterweights 47, 48. The counterweights 47, 48 are the preferred mechanisms for biasing the gates 36, 37 to the solid line position illustrated in FIGURE 4 (the position illustrated in FIGURE 5), although under some circumstances other mechanical biasing structures, such as springs of all different types, weight and pulley type arrangements, or the like, may be provided instead of the counterweights 47, 48 (which are substantially directly connected to the shafts 40, 41).

According to the present invention, means are provided -- preferably mechanical means -- for synchronizing movement of the gates 36, 37 between the solid and dotted line positions of FIGURE 4, so that fluent solid material (wood chips or other comminuted cellulosic fibrous material) flowing into the vessel 21 hollow interior between the gates 36, 37 falls into the interior substantially immediately beneath the area of engagement 38, 39 of the gates when in the solid line position of FIGURE 4, the vessel interior substantially immediately beneath this area of engagement typically being the center line of the vessel 21 (although the chip discharge may be biased, as needed, to one side of the vessel 21 rather than along the centerline).

In the embodiment illustrated in FIGURES 4 and 5, the mechanical synchronizing means comprises at least a first sprocket, sheave, or pulley 50 mounted for rotational movement with the first shaft 40, and at least a second sprocket, sheave, or pulley 51 mounted for rotational movement with the shaft 41. At least one

mechanical interconnecting element, such as a chain, V-belt, or toothed belt 52 is provided between the elements 50, 51, being fixed to the elements 50, 51 at the points 53, 54 illustrated in FIGURE 4.

The elements 50, 51 may be about 6-14 (e.g. ten) inches in diameter. The element 52 may be a conventional power transmission chain, roller chain (single or double pitch), inverted tooth chain, detachable link chain, engineering steel chain, or the like and need not completely surround the elements 50, 51, but may instead only engage an arc of about 90°-180°, as illustrated in FIGURE 4. Where the element 52 is a chain it may be connected as indicated at 53, 54 by welding or mechanical fasteners, and where the element 52 is some sort of a belt it may be connected at 53, 54 by mechanical fasteners, or the like.

While under some circumstances the synchronizing mechanism as described above can operate with only one set of mechanical elements 50-52, it is preferred that two sets be provided as illustrated in FIGURE 5, a third sprocket, sheave, or pulley 56 connected to the shaft 40 while a fourth such element 57 is connected to the shaft 41, with a second interconnecting element 58 (e.g. chain, pulley, or the like) between them, all as seen in FIGURE 5.

The mechanical means for synchronizing gate movement may also include a means for adjusting the relative movement. For example, the chain 52 and sprockets 50, 51 shown in FIGURES 4 and 5 may include a turnbuckle -- shown schematically at 59 in FIGURE 5 -- (or a comparable structure such as overlapping belt portions with adjustment holes and fasteners or the like) located within the length of chain 52 for varying the chain length and hence the relative gate movement.

FIGURE 6 illustrates an alternative embodiment to the synchronizing means illustrated in FIGURE 4. In this case the

shafts 40, 41 move in synchronism due to the gear segments 60, 61 connected thereto (either single or multiple gear sets), interconnection between the gear segments 60, 61 being provided by the directly intermeshing gear teeth 62, 63. Instead of direct intermeshing between the gear teeth 62, 63, as seen schematically in FIGURES 7 and 8 pinion gears 64, 65 may be provided cooperating with a rack 66. Note that in the FIGURE 6 embodiment a counterweight action may be provided by the weights of the gear segments 60, 61, themselves -- i.e. separate counterweights 47, 48 are not necessary. Also in all embodiments where multiple mechanical elements are provided for synchronization they may be mounted on the same side of the inlet conduit 26 rather than on opposite sides as illustrated in FIGURE 5. Also, the counterweights, shown typically by 47, 48 in FIGURE 5 may be located between the synchronizing means and the inlet 26 instead of outside of the means as shown.

In addition to the mechanical means presented earlier, the movement of the gates 36, 37 may also by synchronized by means of other mechanical means, such as linkages, or even hydraulically. A typical linkage mechanism is shown in FIGURE 9. In FIGURE 9, two bars or linkages, 101 and 102 are rigidly connected at one end to their respective shafts 40 and 41. At the opposite ends, the bars are pivotally connected to a connecting member 103 by means of pins 104 and 105. Connected as such, rotation of shaft 41, for example, also causes rotation of shaft 40 such that the movement is synchronous.

It will thus be seen that according to the present invention an improved chip bin assembly, inlet system for allowing entrance of fluent material into the chip bin, and method of acting upon wood chips or the like in a chip bin, are provided. While the invention has been herein shown and described in what is presently conceived to be the most practical and preferred embodiment it will be apparent to

those of ordinary skill in the art that many modifications may be made thereof within the scope of the invention, which scope is to be accorded the broadest interpretation of the appended claims so as to encompass all equivalent structures and methods.

WHAT IS CLAIMED IS:

1. A chip bin assembly, comprising

a generally vertical vessel having a top and a bottom and a generally hollow interior, and an inlet for fluent solid material at said top thereof for introducing fluent solid material into said interior;

first and second gates mounted within said vessel interior beneath said inlet, said gates each mounted for pivotal movement about a generally horizontal axis for movement from a first position in which said gates are substantially in engagement with each other at an area of engagement to preclude the passage of fluent solid material from said inlet into said vessel interior, to a second position in which said gates are spaced from each other a distance sufficient to allow passage of fluent solid material between them into said vessel interior;

mechanical means for biasing said gates to said first position; and

mechanical means for synchronizing movement of said gates between said first and second positions so that fluent solid material flowing into said vessel interior between said gates falls into said vessel interior substantially immediately beneath said area of engagement of said gates when in said first position.

2. An inlet system for allowing entrance of fluent solid material into a hollow vessel interior, comprising:

first and second generally horizontal parallel shafts, horizontally spaced from each other defining first and second axes, respectively;

first and second gates mounted to said first and second shafts, respectively, for movement with said shafts, each gate having an

abutment portion adapted to abut the other of said gates to provide a seal substantially precluding the passage of fluent solid material therebetween;

first and second counterweights connected to said first and second shafts, respectively, for biasing said shafts to a first position in which said gate abutment portions substantially abut each other;

first and second mechanical elements, distinct from said gates, connected to said first and second shafts, respectively, for movement with said shafts about said first and second axes; and

at least one mechanical interconnecting element for interconnecting said first and second mechanical elements to provide substantially synchronized movement thereof.

3. A method of acting upon comminuted cellulosic fibrous material, utilizing a chip bin having a top with a material inlet, and first and second gates beneath the inlet, the gates having abutment portions for engagement with each other; said method comprising the steps of:

(a) introducing comminuted cellulosic fibrous material into the chip bin inlet to fall onto the gates, supported thereby;

(b) biasing the gates toward a first position in which the abutment portions of the gates engage each other and substantially preclude the passage of comminuted cellulosic fibrous material therebetween; and

(c) when the weight of the comminuted cellulosic fibrous material exceeds the bias provided in step (b), causing the abutment portions of the gates to move, in substantially synchronous movement, away from each other, so that the comminuted cellulosic fibrous material falls between the gates into the chip bin interior.

4. A chip bin assembly as recited in claim 1 further comprising means for adding steam to said interior of said vessel to steam fluent solid material therein.

5. A chip bin assembly as recited in claim 4 wherein said vessel includes a single-convergent bin transition adjacent said bottom of said vessel.

6. A chip bin assembly as recited in claim 5 wherein said vessel bottom is directly connected to a chip meter or low pressure feeder, being devoid of a vibrating discharge.

7. A chip bin assembly as recited in claim 1 wherein said mechanical means for biasing said gates comprises first and second counterweights operatively connected to said first and second gates, respectively.

8. A chip bin assembly as recited in claim 7 wherein said first and second gates are mounted for pivotal movement to first and second generally horizontal, parallel, shafts, horizontally spaced from each other; and wherein said mechanical means for synchronizing movement of said gates comprises mechanical elements connected to said shafts for movement therewith.

9. A chip bin assembly as recited in claim 8 wherein said mechanical elements comprise first and second sprockets connected to said first and second shafts, respectively, and a first chain connected between said sprockets.

10. A chip bin assembly as recited in claim 8 wherein said mechanical elements further comprise third and fourth sprockets connected to said first and second shafts, respectively, and a second chain connected between said third and fourth sprockets.

11. A chip bin assembly as recited in claim 8 wherein said mechanical elements comprise first and second sheaves or pulleys connected to said first and second shafts, respectively, and a first belt connected between said sheaves or pulleys.

12. A chip bin assembly as recited in claim 8 wherein said mechanical elements comprise first and second gear segments having operatively intermeshing teeth connected to said first and second shafts, and wherein said gear segments have sufficient mass to also comprise said mechanical biasing means.

13. A chip bin assembly as recited in claim 12 wherein operative meshing of said gear teeth is provided by a rack and a direction-reversing idler gear.

14. An inlet system as recited in claim 2 wherein said first and second mechanical elements comprise first and second sprockets, and wherein said at least one mechanical interconnecting element comprises a chain.

15. An inlet system as recited in claim 2 wherein said first and second mechanical elements comprise first and second sheaves, and wherein said at least one mechanical interconnecting element comprises a V-belt.

16. An inlet system as recited in claim 2 wherein said first and second mechanical elements comprise first and second pulleys, and wherein said at least one mechanical interconnecting element comprises a toothed belt.

17. An inlet system as recited in claim 2 wherein said first and second mechanical elements comprise gear segments, and wherein said at least one mechanical interconnecting element comprises gear teeth provided on said gear segments, said gear teeth directly intermeshing.

18. An inlet system as recited in claim 2 further comprising third and fourth mechanical elements, distinct from said gates, connected to said first and second shafts, respectively, and spaced along said shafts from said first and second mechanical elements, for movement with said shafts about said first and second axes; and at least one second mechanical interconnecting element for interconnecting said third and fourth mechanical elements to provide substantially synchronized movement thereof.

19. A method as recited in claim 3 wherein step (b) is practiced by biasing the gates toward each other with counterweights.

20. A method as recited in claim 3 wherein step (c) is practiced by mechanically synchronizing the movement of said gates toward and away from each other.

21. A method as recited in claim 3 comprising the further step (d) of steaming the material in the chip bin.

22. A method as recited in claim 3 wherein the abutment portions are substantially on a vertical centerline of the chip bin when the abutment portions are in engagement with each other; and wherein step (c) is practiced so that the fibrous material falls between the gates into the chip bin interior substantially at the centerline of the chip bin.

23. An inlet system as recited in claim 17 wherein said gear segments have sufficient mass to comprise said counterweights.

24. An inlet system as recited in claim 2 wherein said first and second mechanical elements comprise gears, and wherein said at least one mechanical interconnecting element comprises a rack and an idler gear.

25. A chip bin assembly as recited in claim 1 wherein said mechanical means for synchronizing comprise a linkage mechanism.

FIG. 1
PRIOR ART

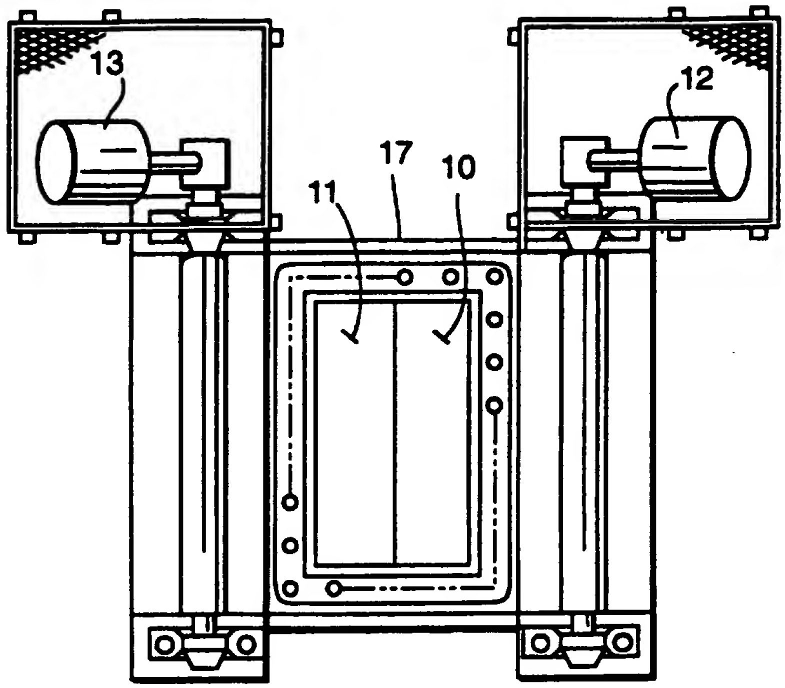

FIG. 2
PRIOR ART

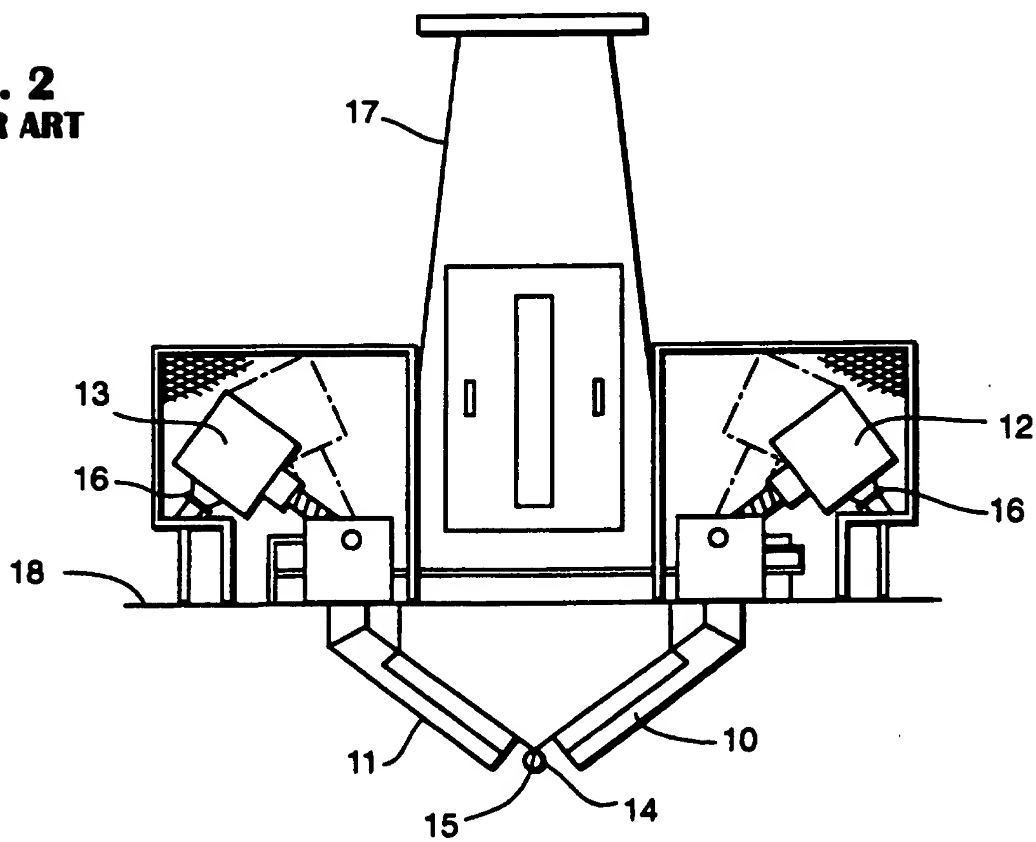

FIG. 3

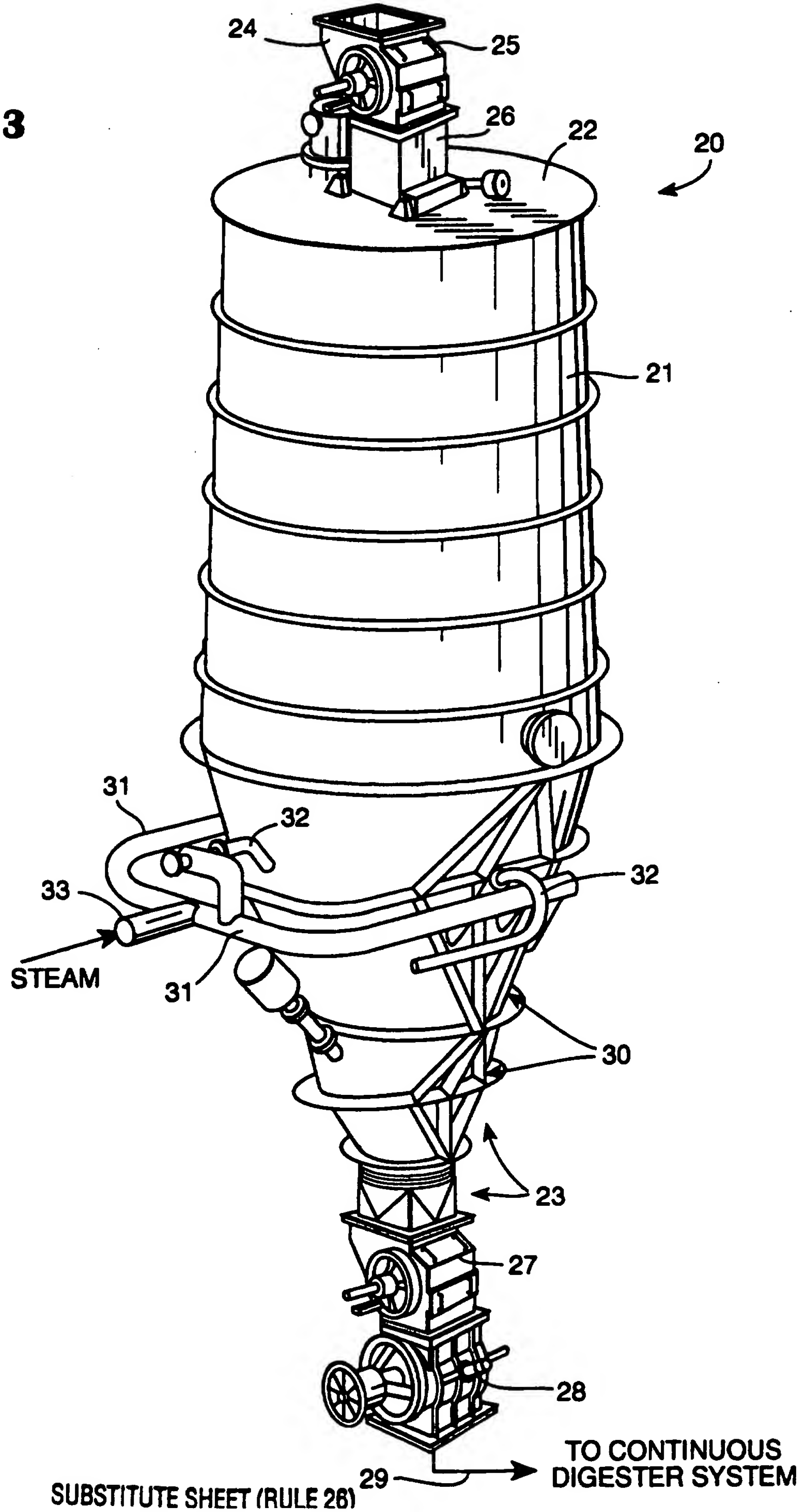
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FIG. 4

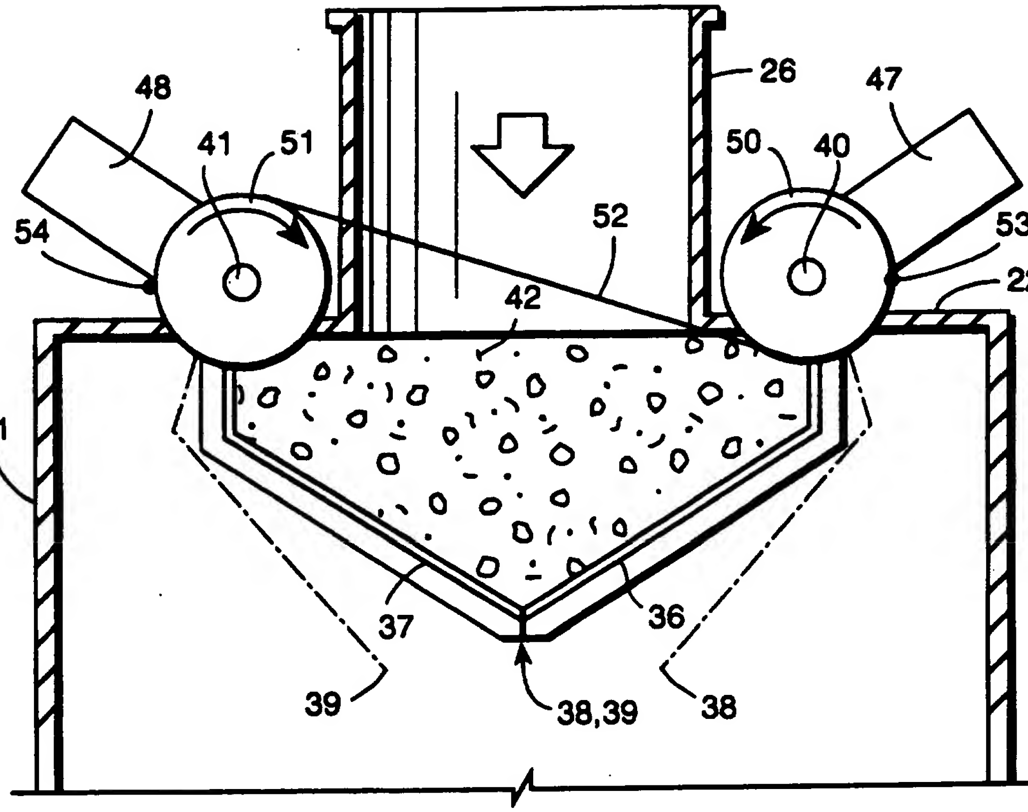
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FIG. 5

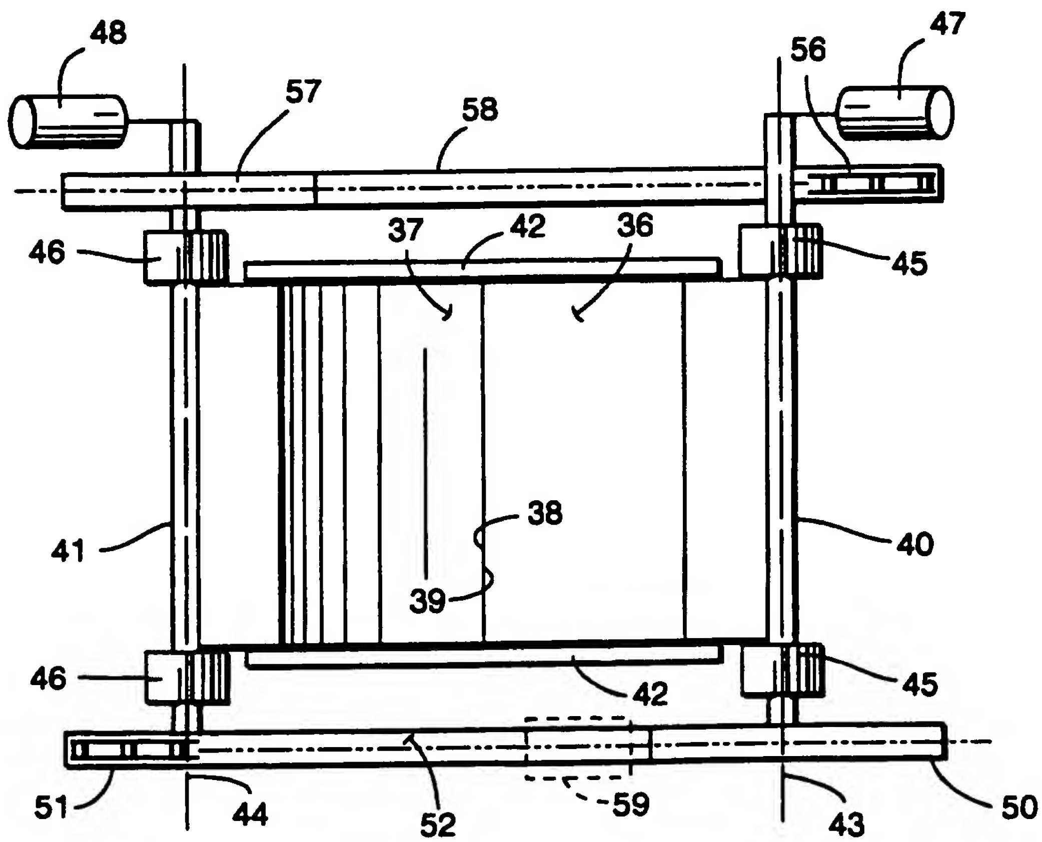
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FIG. 6

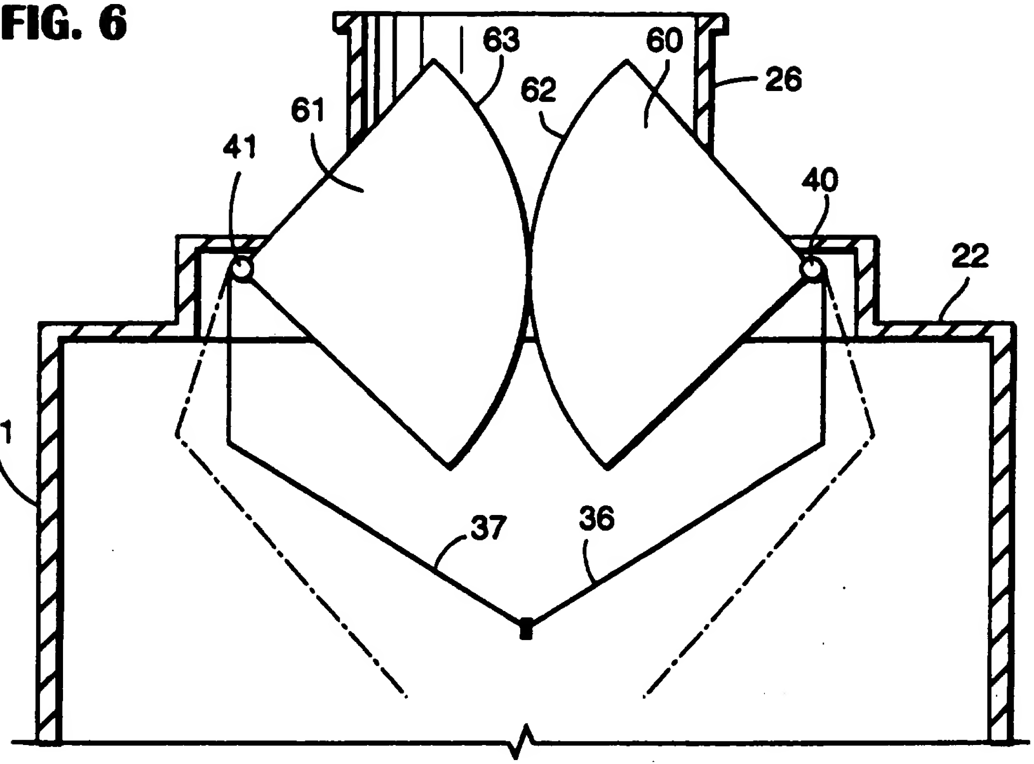


FIG. 9

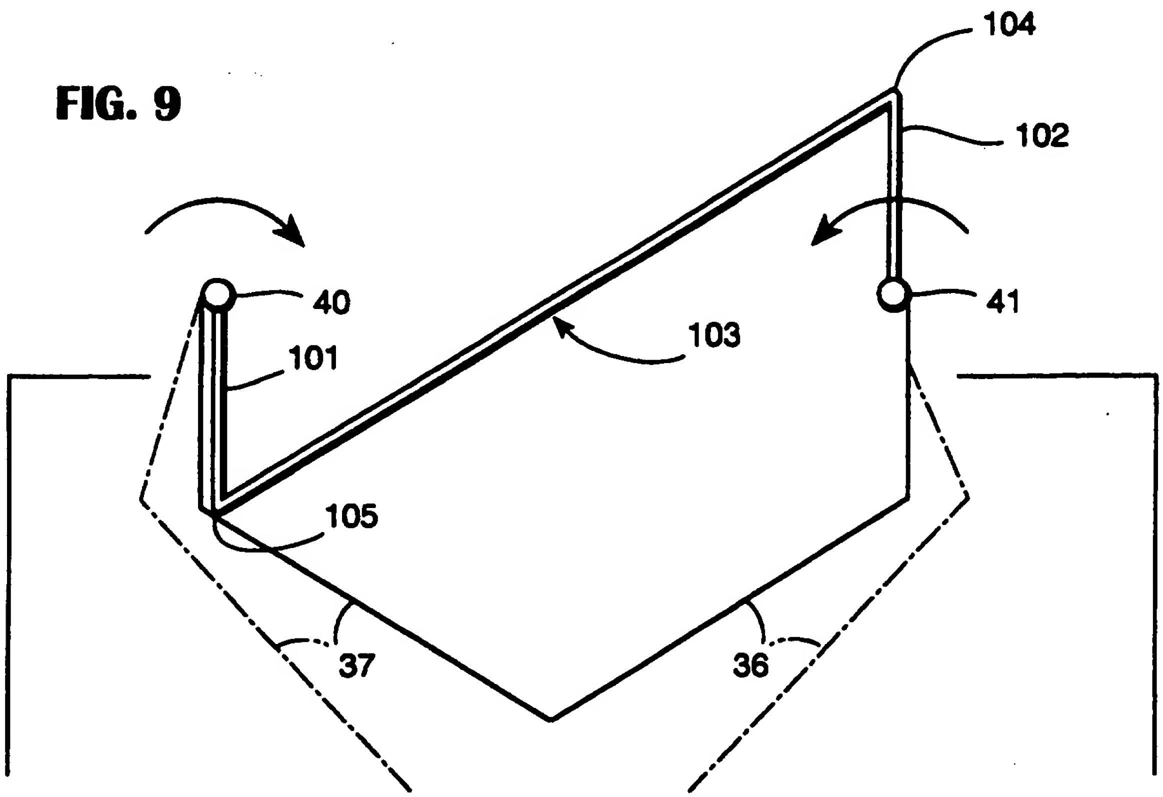
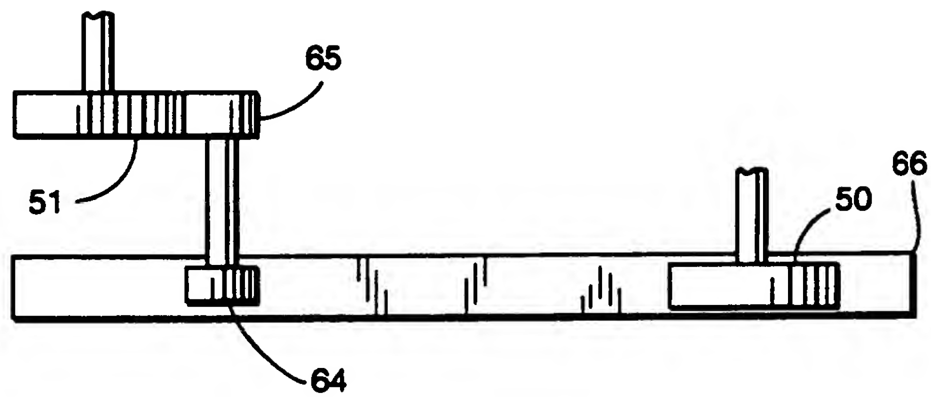


FIG. 8



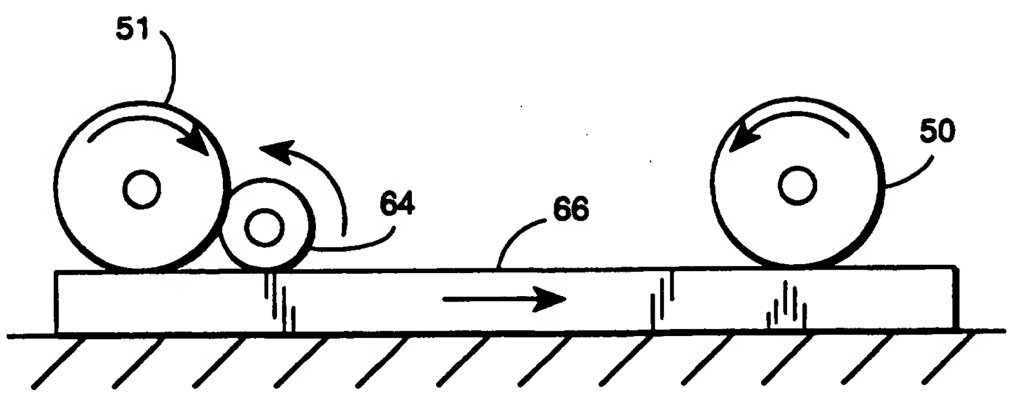


FIG. 7

INTERNATIONAL SEARCH REPORT

Inte   nal Application No
PCT/US 95/12640

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D21C7/06 D21B1/02 B01J3/02 B65D90/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 D21B D21C B65D B01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US,A,4 927 312 (M.D. MEREDITH ET AL.) 22 May 1990 cited in the application see claims 1-5; figures 1-4 see column 1, line 62 - column 2, line 43 see column 4, line 50 - line 61	1-4,7,8, 17-22,25
A		12,24

Y	GB,A,1 175 179 (DOMINION MAGNESIUM LIMITED) 23 December 1969 see figures 1-3 see page 1, line 73 - page 2, line 27 see page 2, line 31 - line 44	1,4,7,8, 25
A		2,3,18, 20

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
21 February 1996	01.03.96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Häusler, F.U.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 95/12640

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A		1,7,8, 12,24

A	EP,A,0 356 290 (ARBEL FAUVET RAIL S.A.) 28 February 1990 see figure 1 see column 4, line 32 - line 35	1-3,8, 18,20, 22,25

A	CH,A,234 488 (MIAG MÜHLENBAU UND INDUSTRIE AKTIENGESELLSCHAFT) 16 January 1945	

A	BE,A,568 680 (SOCIÉTÉ ÉTABLISSEMENT ARBEL ET AL.) 18 November 1960	

A	DE,B,12 90 052 (WESTFÄLISCHE MASCHINENBAU-GESELLSCHAFT M.B.H.) 27 January 1966	

A	FR,A,2 255 947 (OY W ROSENLEW AB) 25 July 1975	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 95/12640

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DE-B-1100556		NONE		
EP-A-356290	28-02-90	FR-A-	2635092	09-02-90
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BE-A-568680		NONE		
DE-B-1290052		NONE		
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		DE-A-	2459979	03-07-75
		JP-A-	50117170	12-09-75
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